A MODEL TO DETERMINE THE PROPER SAM/VIP AIR FLEET

GRADUATE RESEARCH PROJECT

Jonathan R. Van Noord, Major, USAF

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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Jonathan R. Van Noord, M.A.

Major, USAF

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Abstract

The VIP/SAM fleet at Andrews AFB supports the air transportation of the President and other Washington D.C. dignitaries. Over the last 20 years, the fleet of aircraft have changed in type and numbers. Currently, the fleet cannot support all the requests for airlift it receives. This GRP looks at the aircraft currently assigned to the VIP/SAM fleet and the historical data of missions they fly. With this information and future aircraft possibilities, a model was constructed for the White House Military Office to use to determine the appropriate types and numbers of aircraft given the number of missions scheduled.

I. Introduction

Background

The Special Airlift Mission (SAM) fleet of aircraft, based at Andrews Air Force Base, are flown by the 89th Airlift Wing (AW). The 89AW provides airlift for United States civilian officials classified as Distinguished Visitor (DV) codes 1 and 2 (President, Vice President, Secretary of State, Secretary of Defense, Members of Congress, etc.) as tasked by the White House Military Office (WHMO) and/or appropriate U.S. Air Force agencies via the Office of the Assistant Vice Chief of Staff/Special Air Missions (CVAM). (Filcek, 2001) The number of individuals and organizations in Washington D.C. that qualify for this type of airlift number over 800, not including senior staff members that travel with the individual. (Filcek, 2001) Policy states that commercial aircraft shall generally be used as the most economic means of travel but military aircraft may be used for official White House support missions if commercial travel is inappropriate or unavailable. In order to qualify for the SAM aircraft, the travel must also be categorized as Defense related, in direct support of the President, Vice President, or first Lady, specifically directed by the President, or required to meet national security concerns. (Card, 2001)

As shown since September 11, SAM is especially important. During this time, as at other times in history, when national security strategy is moved to the forefront of our government, the availability of Executive level aircraft is of the utmost importance. (Pike, 2000)

The last months have proven the need for high-level physical security and made us more aware of communications security. Mission protocol dictates the use of civilian airports by aircraft that provide comfortable and functional transportation for our leaders. Our leaders are required to work and rest while traveling, are under very stringent schedules and are always under the scrutiny of the media. With these highly visible missions, and the renewed need for our leaders to have the ability to depart locations in minimal time for security reasons, a dedicated special airlift fleet is required.

Problem

With the large number of people qualified to use and requiring SAM aircraft, the 89AW cannot currently support the demand. Changes in types and total numbers of aircraft in the SAM fleet have degraded the ability of the 89AW to provide the same level of support as they have in the past. New aircraft must be added to the inventory in order to better support the customer.

Even though there are guidelines to limit the use of the SAM fleet, there are still a large number of people that require this type of airlift. The most common reason commercial aircraft cannot be used is the timing factor and restrictive schedules of the commercial flights. The problem occurs when there are not enough airframes to support all the missions demanded. In reality, the SAM fleet can support only a portion of all the requests made. There is another group of aircraft designated Operational Support

Aircraft (OSA) that are used to support DV travel as well. These aircraft belong to each military service and are normally used by top officials in each of the services. They can and are occasionally used by DVs that request SAM fleet support but are denied for lack of aircraft. Even with these additional OSA aircraft, the demand for aircraft exceeds the supply of aircraft.

Research Objectives

The objective of this graduate research project is to provide the White House Military Office (WHMO) a tool to determine the proper mix and numbers of aircraft for an optimal SAM fleet of aircraft. The tool is an excel computer model. The original intent was to provide WHMO with the actual numbers and types of aircraft that are needed to support White House missions; however, the data needed to determine that number is not available, not tracked, and/or not releasable. Numerous attempts were made to obtain actual numbers of denied requests for lack of airframes. Unfortunately, this number was not obtained.

The focus of this GRP is to provide a working computer model for the office to use at their discretion. This allows WHMO to input their own data and also put in future needs or aircraft as they are added, giving them a more useful product they can change as required.

II. Literature Review

Aircraft Performance and Costs

The 89AW has many different types of aircraft that have a wide variety of performance characteristics and capabilities. I have categorized them as large, medium, or small aircraft depending on the numbers of passengers they can carry. The small aircraft have a passenger capacity of 15 or less, the medium aircraft have a passenger capacity of 16-39, and the large aircraft have a passenger capacity of 40 or more. The small aircraft include the C-20B/H, and the C-37 aircraft. The large aircraft inventory is made up of C-25, C-32, C-137, and C-9 aircraft. When discussing the per hour flying cost of these aircraft, the cost includes crew per diem and billeting, fuel, spare parts, and maintenance hours associated with each flying hour.

The C-20B aircraft are actually modified Gulfstream III aircraft. The C-20H is a Gulfstream IV aircraft. Both variants of these aircraft can carry up to 12 passengers and cost $29.4 M in FY 98 constant dollars to purchase. The flying cost for these aircraft is $3,573 per hour. The range in nautical miles (NM) is 3,698 for the C-20B and 4,850 for the C-20H. The 89AW currently have five C-20B aircraft and two C-20H aircraft. The C-20B aircraft have been flying with the Air Force since 1988 and the C-20H since 1992.

(Office of Public Affairs Air Mobility Command, 2001; White House Military Office, 2001)

The other small aircraft that the 89AW flies is the C-37. The C-37 is also a Gulfstream product, a Gulfstream V. Like the C-20 aircraft, it can only carry 12 passengers, but with a range of 5,500 NM and a speed of 600 mph, it can fly farther, faster, and higher than the C-20s. Each aircraft cost $36M to purchase and $4,396 per hour to operate. (Office of Public Affairs Air Mobility Command, 2001; White House Military Office, 2001)

The C-9C aircraft is a modified DC-9 aircraft from the civilian commercial fleet. The first Air Force variant, the C-9A, started flying in 1968. The C-9C can carry up to 42 passengers which classifies it as a large aircraft, but the range of the aircraft is extremely poor, only 2,500 miles. When purchased, the aircraft cost $21M and currently costs $3,443 per hour to operate. (Office of Public Affairs Air Mobility Command, 2001; White House Military Office, 2001)The aircraft does have the benefit of being able to operate out of smaller airfields, but its age creates some very significant problems. First, the range of the aircraft is very limited compared to the other aircraft in the fleet. The aircraft is usable for some stateside missions, but it is extremely limited in its ability to fly over seas. It also does not comply with international noise restrictions and lacks minimum navigation requirements. (Irwin, 2001)

The newest aircraft in the SAM fleet is the C-32A, which is a specially configured Boeing 757-200 commercial aircraft. This aircraft has a total seating capacity of 45 with a fully enclosed stateroom and a conference and staff facility. The aircraft has gone through extensive upgrades and never was intended to serve as Air Force One. Because

of this, the required Presidential communications suite was not included in the modifications. (Bautz, 2001) The aircraft does have great capability in speed and range with the ability to fly at 530 mph with a range of 5,500 NM. This aircraft is unique to the Air Force acquisition process. The C-32A is the first airframe to be purchased using the commercial off-the-shelf process. This drastically shortened the time it took from contract award to delivery, less than two years. The per hour flying cost of the C-32A is $10,062. (Office of Public Affairs Air Mobility Command, 2001; White House Military Office, 2001)

The C-137C is also a commercial derivative. A modified Boeing 707, the C-137 was used as Air Force One from 1962 until the VC-25 was purchased. After the purchase of the VC-25A aircraft, the C-137C was used as a backup aircraft for Air Force One. Because it was used as Air Force One, it has a stateroom and the proper communications equipment necessary to support the President. The aircraft can carry 42 passengers on a normal DV mission and 40 on a Presidential mission. The hourly operating cost of the C-137 is estimated at $10,543. This aircraft is old, like the C-9C, and has been slowly phased out of the SAM fleet.(Office of Public Affairs Air Mobility Command, 2001; White House Military Office, 2001)

The most recognizable and prestigious aircraft in the SAM fleet is the VC-25A. A highly modified Boeing 747-200B, it is used exclusively for the President as Air Force One. Because its only mission is to fly the President, it has been modified to specifically meet that mission. It has an electronic and communications suite that allows worldwide communications and navigation. The interior configuration includes an executive suite with a dressing room, lavatory, and shower, as well as the President's office. A separate

conference/dining room is also on the aircraft. Separate areas accommodate guests, Secret Service and security personnel, media personnel, two galleys, six lavatories, and a rest area with a mini-galley for the aircrew. The aircraft can carry a total of 71 passengers plus a crew of 26. Mechanical modifications include in-flight refueling capability, self-contained baggage loader, and front and aft air-stairs. (Office of Public Affairs Air Mobility Command, 2001)

This very capable aircraft has an unrefueled range of 6,800NM and a virtually unlimited range when using in-flight refueling. The fastest of all SAM aircraft, the aircraft can fly at a speed of 630mph. The cost for flying this special aircraft is estimated at $58,400 per hour.(White House Military Office, 2001)

Future Aircraft

One aircraft, which currently is planned to join the fleet, is a B-737 derivative. (Early Bird, 2001)The Air Force designation will be C-40B. The approximate procurement cost will be $75 million per aircraft, with an estimated hourly flying cost of $7,500. (Irwin, 2001) The C-40B will be able to carry 26 passengers with 11 crew members and fly more than 5,000 miles. Like the C-32A, the cruising speed of the C-40B will be 530mph. (Perry, 2002)

Another possible aircraft that could be added to the fleet is the B-767. If the aircraft is purchased in small numbers and when compared to other Boeing aircraft, it is reasonable to assume that the procurement cost would be close to $130 million a piece with an hourly flying cost of $13,000. After the announcement that the Air Force may lease up to 100 B-767 aircraft for use as tankers, it is reasonable to assume that four more

could be added to the lease for the same price and be used in the executive fleet. For the purpose of this GRP a figure of $100M per aircraft was used as an acquisition cost. This cost is actually the lowest possible cost for a B-767 would sell for. (Global Security)

Maintenance

The age of some of the aircraft is a maintenance issue. The age of the aircraft determines the number of maintenance inspections required by the FAA. These inspections can be very costly. In fact, the retirement order of the C-137s was determined by which aircraft had inspections coming due. The one that needed the inspections first was retired instead. (Miner, 1997, March) One benefit of consolidating the types of aircraft would be to cut down on the spare parts storage and the number of maintenance workers. It would seem obvious that by reducing the types of aircraft, the total number of maintainers could be decreased. Or, the maintainers that we have at present could concentrate on fewer airframes giving us more experts per airframe. Fewer types of aircraft would also reduce the number and type of aircraft parts we need to keep on hand.

Although true when the Air Force is taking care of the aircraft, when maintenance is outsourced to a private contractor, the Air Force burden is diminished. Recently, the 89AW has gone to contract maintenance in an effort to reduce cost for the Air Force and lessen their responsibility. This has been a great benefit to the 89AW. Because the aircraft have civilian equivalents getting spare parts is not a problem. The contractors have set up agreements with the aircraft manufacturers for a just in time supply type

system. If any part is out of stock at the time it is needed, the aircraft/part manufacturer has the part shipped via commercial air, usually within three hours. (Perry, 2002)

Past Aircraft Type and Numbers

The make up of the Executive Fleet has essentially "flipped" in the last 20 years in regards to large and small aircraft. In the early 1980s, the fleet had 10 large aircraft consisting of three C-137Bs, four C-135B aircraft, and three C-9C aircraft. The small aircraft consisted of seven C-140B aircraft. The total passenger lift capability of these aircraft was 490. (Filcek, 2001)

In the early 1990s the mix of aircraft remained at 10 large and 7 small aircraft; however, the four C-135B aircraft were replaced by four C-137C aircraft. The small aircraft numbers remained at seven with C-20B aircraft replacing the C-140B aircraft of the 1980s. With the two new aircraft, passenger capacity went up to 634. (Filcek, 2001)

At the end of 2001, the passenger capacity is at its lowest point, 426. The fleet numbers have flipped with seven large aircraft and ten small aircraft. The large aircraft included four C-32A aircraft and three C-9C aircraft. The notable difference here is that the C-32A, which is considered a large passenger carrying aircraft, can carry only 45 passengers. The large passenger carrying aircraft of the 80s and 90s, the C-137B/C, had a 60+ passenger carrying capability. The small aircraft fleet included C-20B, C-20H, and C-37A aircraft. (Filcek, 2001)

Current Aircraft Type and Numbers

The years from 1998 to present have seen a dramatic change in the types of aircraft in the executive fleet. Three C-32s and one C-37 arrived in 1998 while the fleet

lost one C-137C. In 1999, one more C-137C aircraft retired while one C-37 and one C-32 were added. The third C-32 arrived in 2000. (Perry, 2002)

Most recently, the Air Force has gotten rid of tail number 27000, a VC-137, which served as Air Force One during the 1970s and 1980s. It was retired in September 2001 and flown to California to be put in the Reagan Presidential library. ("*Former Air Force One Retires to Reagan Library,"* 2001) After the 747s were purchased, the C-137 served as the dedicated backup aircraft for the VC-25. (Perry, 2002) Now that this aircraft is gone, the Presidential fleet of two VC-25s cannot handle the load of both primary and backup aircraft. At any given time, one of the VC-25 aircraft is in depot level maintenance or having upgrades completed. During a calendar year, the two aircraft are on the flight line together for only 30 days. (Bautz, 2001)

This means that another aircraft, the C-32, must now fill in as a backup aircraft to Air Force One. The current number of C-32 aircraft in the executive fleet is four. With at least one of these aircraft in heavy maintenance at all times and one usually on the line providing back up for Air Force One, only two are available for other missions.(Bautz, 2001)

Projected Aircraft Type and Numbers

There are many ideas held by those that are currently working with the fleet. From the 89AW Operational Support Squadron viewpoint, a good mix of aircraft would minimize the total number of aircraft types and increase the number of to both the large and small aircraft. One view point is to keep the two VC-25 aircraft, increase the C-32A

numbers to seven, get rid of the C-20 aircraft, increase from three to fifteen the number of C-37A aircraft, and add three C-40B aircraft. (Holmes, 2001)

Currently, there is a plan to continue to modify the fleet throughout the next seven years. The C-20H aircraft are due to be sent to the special airlift fleet in Europe sometime in FY 2002. (Bautz, 2001) By 2007, only two C-20B aircraft will remain at Andrews AFB with the last two departing the fleet by 2009. (Holmes, 2001) As the C-20s are leaving the fleet, C-37 aircraft will be added to the fleet with numbers reaching seven by FY2007 and a total of nine by FY2009. The C-32A fleet is scheduled to remain unchanged through FY 2009 and the C-9C is scheduled for retirement in FY2006 or 2007. Finally, one B-737 type aircraft is scheduled to join the fleet sometime in FY2002 with additional aircraft being added through FY2006 totaling five. (Holmes, 2001)

Number of Missions Flown by Aircraft Type

The following charts show the numbers of missions flown the past from 1998 to 2001 by year. Chart 1 shows the total number of mission departures broken down by aircraft type. Chart 2 shows the average number of monthly departures per aircraft type.

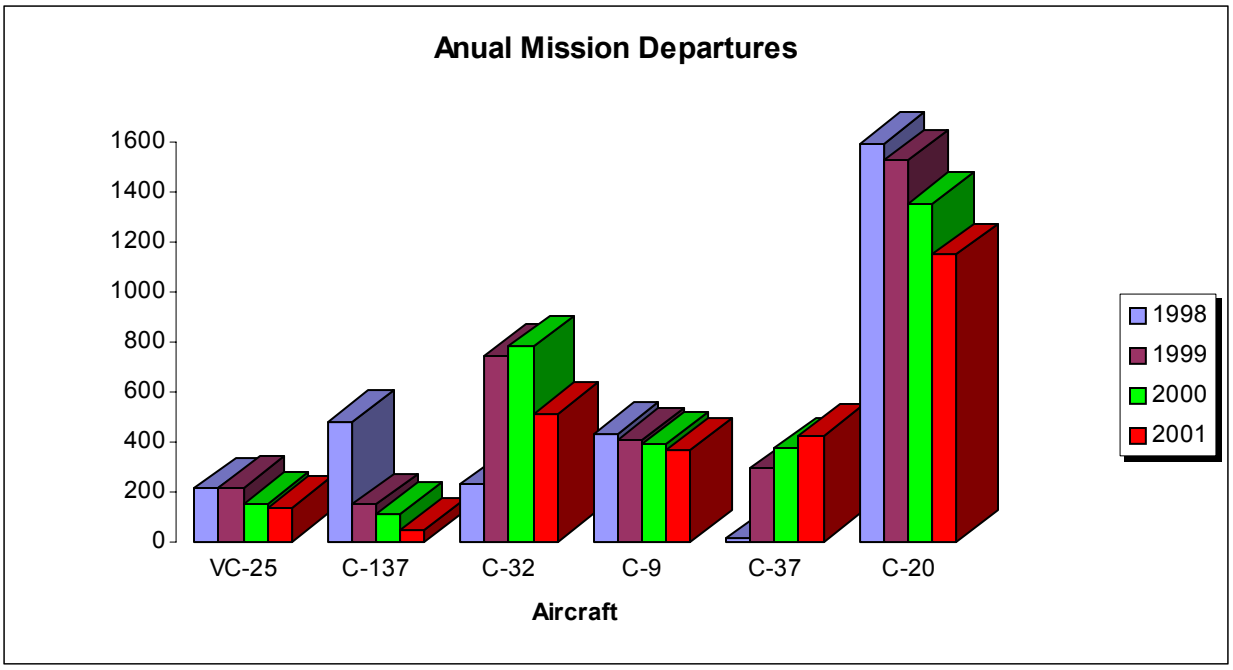

Chart 1

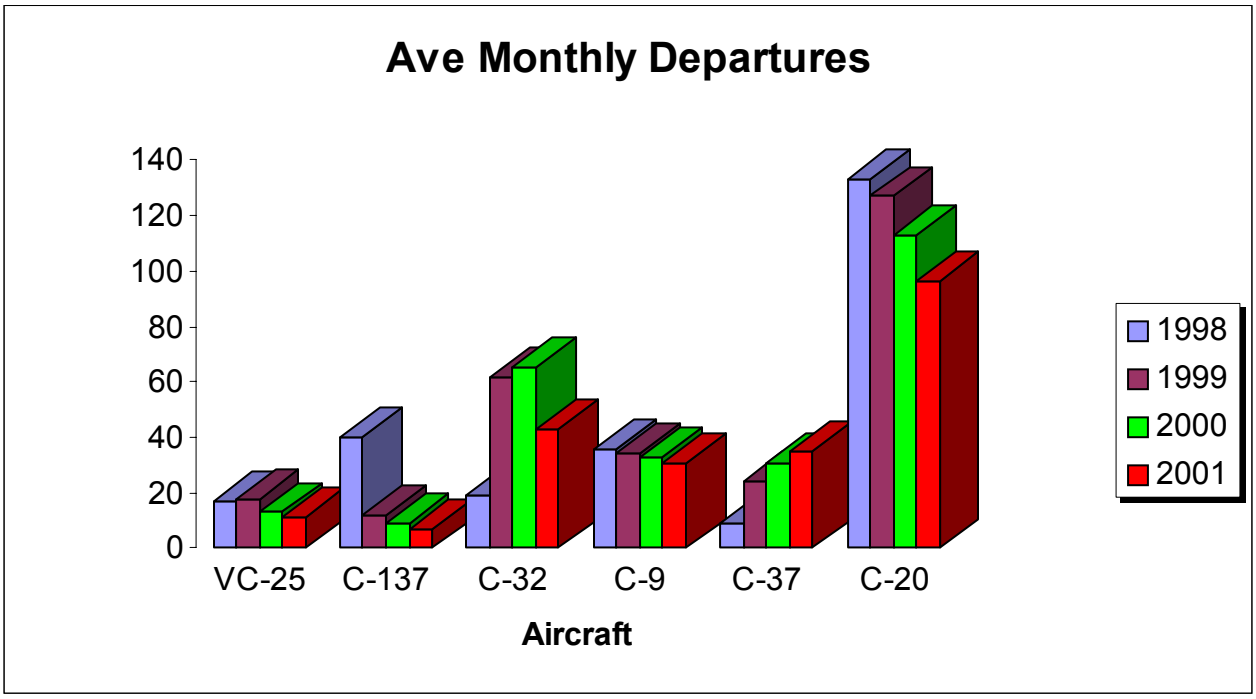

Chart 2

The two charts show that the small aircraft fleet flies a majority of the missions. The C-137 had a drastic decrease while the C-32 had a large increase. These two changes correspond with the retirement of the C-137 and the purchase of the C-32.

With the various aircraft types and changes in the numbers over the years, it is easy to see why a stabilized number and type of aircraft would benefit the VIP/SAM fleet. Fewer types of aircraft with more comparable capabilities would make maintenance, scheduling, pairing up, and last minute changes much easier. The following chapter discusses the model developed to determine which aircraft are needed.

III. Methodology

The Models

The models used in this research project are excel models. The final model that determines which future aircraft should be purchased is an excel based model that uses the add in Solver program. It is important to remember that when the model produces a dollar figure, this figure represents only the costs associated with the extra missions, not the cost of the aircraft currently in the fleet.

Comparing the data from the past four years, the average usage per aircraft has been 18 missions per month. (Holmes, 2002) It is believed that with the current fleet of aircraft, valid requests do get turned down for lack of airframes. In fact, less than 80% of the validated flights are supported. (Filcek, 2001) Because of this, it would seem that the current fleet, operating on an average of 18 missions per month is near its maximum mission capacity. Taking into account maintenance needed to be performed after each flight, and the fact that some missions would take an aircraft to a destination and then sit idle for a few days, 18 missions per month seems to be an accurate number. Within the program, these missions per month can be changed by the user as more information is available. "Total missions available" is also decreased by any standby missions required. These standby missions are performed by the C-32 A for all VC-25, Air Force

One missions, and by the C-20B for all C-32A missions. Because of the importance of the missions flown by these aircraft, a ready spare is always scheduled.

The appendix has the specific instructions on using the model, but a discussion on the basic assumptions and constraints follows. The underlying mathematical model that is solved in the excel spreadsheets is nonlinear. The model is presented below.

Let x_i represent the number of missions flown by aircraft type i in a month.

Define c_i as the cost of a mission by aircraft type i.

Define a_i as the monthly acquisition cost of aircraft type i.

$$\textit{minimize} \quad \sum_i c_i x_i + \sum_i a_i \lceil x_i / 18 \rceil$$

$$\textit{subject to}: \quad \begin{array}{l} x_i \in S \\ x_i \geq 0 \text{ and integer} \end{array}$$

where the symbol $\lceil \ \rceil$ means the smallest integer larger than the amount inside the symbol and S is the set of bounds on the number of mission requests, by aircraft type (large, medium, and small) that remain unfilled by the existing inventory of aircraft.

The bottom line to the model is costs. The model determines the most cost efficient manner of fulfilling the requirements while complying with the constraints.

"Flying hour cost" is how much users are billed per one hour of use for each aircraft. "Missions cost" is the total flying hour cost for all the extra missions needed. The acquisition cost is the total cost to the government to purchase or lease the aircraft. It is assumed that the aircraft will be used for 10 years and has usability of 100%, which means the aircraft is available 100% of the time (18 missions worth per month). The 10 years and 100% are changeable by the user if it is known ahead of time how long the

aircraft will be in the fleet or if it is known how much down time the aircraft will experience. This is then factored against the acquisition cost and turned into a monthly fixed cost. This cost is incurred regardless of whether or not the aircraft is flown. In reality, we know that the government purchases the aircraft and does not make monthly payments or depreciate aircraft value like corporations do, but the author felt it was important to somehow distinguish the cost since it is paid. Therefore, the total monthly cost is the sum of the mission costs and the monthly acquisition cost. This column is then summed for all aircraft to give us the total monthly cost for all additional aircraft.

A large aircraft can only be replaced by a large aircraft and a medium aircraft can only be replaced by a medium aircraft. A medium type aircraft, however, can replace a small aircraft. The reason for this is that the large aircraft are configured for a more specialized mission with specific communications and added capabilities. Thus only a similarly equipped aircraft could fill in. The small and medium aircraft are generally used for transport only and it would be cost inefficient to purchase another small aircraft if there were missions available on a medium aircraft. Thus, the model uses excess availability of a purchased medium aircraft before it buys additional small aircraft.

The models are based on information from the data collected from the 89AW/OSS. The flights were analyzed for the years 1998-2001. Each aircraft type had its monthly tally averaged for each year. The acquisition of new aircraft and retirement of others made it necessary to look at the number of aircraft flying each month. The average number of flying hours per aircraft per month was then computed to come up with one overall average for all aircraft to use in the models. It is this average that is the basis and starting point for the models.

All models can be found in the Appendix.

Model #1

This model represents the inventory of the 89AW as of 1 Jan 2002. The last C-137C was disposed of in September 2001 but the average of 7 missions per month needs to be accounted for and added to the C-32A totals. In this model, the current average monthly missions flown are used, which actually is only 80% of the validated flights as discussed earlier.

Model #2

The second model uses the same basic information as the first; however, it assumes that the fleet will cover 100% of validated requests. This model shows what would be needed to support all validated missions.

Model #3

The age of the C-9C, in addition to its limitation on international flight, makes it inevitable that the C-9C will be eliminated from the fleet of SAM aircraft. In addition, the two C-20H aircraft are scheduled for transfer to another unit in the fall of 2002. Model #3 removes these two aircraft types; however, demand does not decrease. Model #3 uses the current support capability of flying 80% of all validated requests.

Model #4

Model #4 also removes the C-9C and C-20H as in model #3, but model #4 increases the coverage of demand to 100% of validated requests

Model #5

The fifth model uses solver to determine the most economical option for DoD by purchasing more aircraft to meet the demand put in the model. The first four models only have two options for aircraft purchase, the C-32A and C-37A. The rest of the aircraft, except the VC-25, are all older models and will not be used to plus up the fleet. We know that the C-137 has already been retired and the C-9C is too old and has other limitations, so neither of those will be purchased in the future. Considering the age of the C-20s and the capabilities of the C-37A, only the C-37A will be purchased in the future.

The two new aircraft added were the C-40B, a B-737 model, and the C-XX, a B-767. The reason the C-40B was added to the model, was the fact that an unknown number of these aircraft are scheduled to be added to the SAM fleet starting in 2002. (Perry, 2002) Considered only a medium passenger carrying aircraft like the C-9C, it has a much better range than the C-9C. Recent events have added the B-767 to the possible mix of aircraft. With the Air Force considering leasing the B-767 for tankers, it is feasible to take a few from that lot or add a couple to the lease program to serve in the SAM fleet. Acquisition numbers and hourly flying costs for the B-767 and C-40B are estimated from the Boeing web page and by the news that the leased B-767s will cost $100,000,000 per aircraft.

Using solver, in the non-linear mode, the model looks at the total number of large, medium, and small aircraft needed. It then analyzes the different possibilities of number of aircraft to purchase. In the program only large aircraft can be purchased for large requirements and medium aircraft for medium requirements. If small aircraft need to be

purchased, the model first looks at remaining missions available for the medium aircraft. If there are missions still available for the medium aircraft to fly, the model will give those small missions to the medium aircraft up until the point where another must be bought. If a small aircraft must be purchased, then the model will give that small aircraft the maximum number of small requirement missions possible since it is cheaper to fly.

IV. Results

Model #1

The first model was run with the average number of missions flown per aircraft per month using the current fleet of aircraft. Since the C-137 was retired and is no longer in the inventory, it was not available for use by the model. Because it was flown for most of the last year, its missions were included since mission demand will not go down but must be flown by another aircraft, namely the C-32A. Each aircraft type had one aircraft in long-term maintenance, effectively reducing the fleet size by one in all cases. The C-32A was considered to have two aircraft unavailable long term due to extensive modification being accomplished on each aircraft as well as one in long-term depot level maintenance. (Mischo, 2002) The C-20B and C-20H were combined for their flying missions and also for their numbers in inventory, maintenance, and availability.

The VC-25 was scheduled an average of 15 missions per month, which established a requirement for 15 standby missions for the C-32A. The C-137's nine missions were given to the C-32A. In addition to the standby missions for Air Force One and the C-137 missions, the C-32A was scheduled for 20 missions. This created a deficit of 8 missions. The 20 C-32A missions also created 20 standby missions for the C-20s.

The C-9 was scheduled for 17 missions, the C-37A for 14 missions, and the C-20s for 24 missions in addition to its standby missions for the C-32A.

The overall requirement was the need for 8 extra missions, which roughly equates to the missions that the C-137 had to give up because of its retirement. It seems logical that by losing one aircraft, one should be purchased to fill the gap. The 8 extra missions confirm this and because they came from a large aircraft, the model buys one large aircraft, a C-32A. The total cost is $1,220,425 per month to purchase the aircraft and fly the 8 missions.

Model #2

The second run of the model increased the scheduled missions to what is believed to be 100% of requested missions. Although 100% of the President's requested missions are assumed to be accomplished, the scheduled missions for the VC-25 were also increased to a total of 18. The C-137 missions were increased from 9 to 12, which directly affects the C-32A's available missions. The C-32A, already flying the C-137's 12 missions and the 18 standby missions for Air Force One, was scheduled for 24 of its own missions. The C-9C was scheduled for 20 missions, the C-37A for 17 missions, and the C-20s for 30 missions as well as 24 standby missions for the C-32A.

This combination of scheduled missions produced the need for 18 additional missions to be covered. Once again these missions were all in the large aircraft category. Because 18 missions is the limit for missions per aircraft, the model determined correctly that only 1 large aircraft, a C-32A, should be purchased.

The total cost per month for this option was $1,600,123. This included the purchase price and the 18 missions per month.

Model #3

The third model run begins to look at the future of the SAM fleet. It is known that eventually the C-9C will need to be retired from service due to its age and limitations. In the near future, the two C-20Hs will be leaving Andrews Air Force Base, most likely to the OSA fleet in Europe. Model #3 looks at the current supported missions without these two airframes in the inventory.

Air Force One, the VC-25, received its original 15 missions, the C-137 was scheduled for 9 missions, the C-32A has 20 missions, and the C-37A accounts for 14 missions. As in the first two missions, the C-137 missions were covered by the C-32A, but in addition, the 17 missions scheduled for the C-9C also had to be covered by the C-32A. The C-20's missions required was 24, but the number of aircraft able to perform these missions was reduced by the anticipated transfer of 2 C-20Hs .

Even with the reduction of the C-20s, the small aircraft fleet was still able to handle the requirements with room to spare. The large fleet, however, begins to see a noticeable deficit as it picks up the C-9C requirements. The C-32A needs an extra 5 missions from covering the Air Force One standby missions and the C-137 and C-9C missions. This is before it is even scheduled for its own missions. Once it is scheduled for its own missions, the number of extra missions required climbs to 25.

The model purchases two C-32As for these extra missions. The total monthly price is $2,782,579 for the purchase and flying cost of the 25 missions.

Model #4

Model #4, like model #3 looks at the future fleet without the C-9C and the C-20H aircraft. Like model #2, model #4 uses the numbers for 100% of the validated requested missions.

The VC-25 was scheduled for 18 missions, which added the same amount of standby missions to the C-32A. The C-137C was scheduled for 12 missions that were given to the C-32A directly because of the C-137C's retirement. The C-9C was scheduled for 21 missions, which were also given to the C-32A to fill. These scheduled and standby missions gave the C-32A a deficit of 15 missions before its 24 missions were even scheduled. The C-37A aircraft were scheduled for 17 missions and the C-20B were scheduled for 30 missions in addition to the 24 standby missions it needed to perform for the C-32A.

The loss of the C-20H aircraft had no affect on the small aircraft numbers. The loss of the C-9C, however, did push the requirement to purchase more large aircraft up to a total of three.

Thirty-nine missions required additional support. All of these missions were a shortfall in the large aircraft category. At the rate of 18 missions per month, three additional C-32A's required procurement. The total monthly cost of the 39 missions came to a total of $4,230,823.00

Solver Model

The solver model was built on the basic excel models as in the previous four. Added to the choice of aircraft were a large aircraft, the Boeing 767, the C-XX, and a medium size Boeing 737, designated the C-40B. When faced with purchasing more aircraft to fulfill needed missions, solver picks the least costly aircraft purchase alternative that meets the requirement. The acquisition costs and flying hour costs are estimated from various sources including the Boeing web site, the possibility that the Air Force will be leasing a tanker version of the B-767 for $100,000,000, and by comparing the cost of the current aircraft.

The model assumes 18 missions per month for each available aircraft. The program determines whether a large, medium, or small aircraft needs to be purchased. If large missions are required, solver has a choice of two aircraft, the B-757 or B-767. Analysis shows if seven or less missions are required, the B-767 is the least costly choice. If eight or more missions are needed, then purchasing and flying a B-757 is the least costly choice. This number is not programmed into the model.

If any medium sized aircraft missions are needed, solver will produce a purchase of a C-40B aircraft. If small aircraft missions are needed, and a medium aircraft has been purchased, solver will try and give as many of the small missions as possible to the medium aircraft already purchased before buying a small aircraft.

Solver Model, 80% run, all aircraft

Like model one, this model was run at the current mission acceptance rate of 80%. This solver model also accounts for the missions flown by the C-137. Any

missions scheduled for the C-137 were deducted from the total missions available for the C-32A. All the maintenance assumptions affecting the first four models were also used in the solver models.

The VC-25 was scheduled an average of 15 missions per month, which established a requirement for 15 standby missions for the C-32A. The C-137's nine missions were given to the C-32A. In addition to the standby missions for Air Force One and the C-137 missions, the C-32A was scheduled for 20 missions. This created a deficit of 8 missions. The 20 C-32A missions also created 20 standby missions for the C-20s. The C-9 was scheduled for 17 missions, the C-37A for 14 missions, and the C-20s for 24 missions as well as its standby missions for the C-32A.

The overall requirement was the need for 8 extra large aircraft missions. As stated before, if 8 or more missions are required, the option that cost the least is purchasing a B-757. The total cost is the $1,220,425 per month to purchase the aircraft and fly the 8 missions. This matches the results achieved by model #1.

Solver Model, 100% run, all aircraft

Model #2 increased the scheduled missions to what is believed to be 100% of requested missions. The scheduled missions for the VC-25 were increased to 18, and the C-137 missions were increased from 9 to 12. Both of these aircraft directly reduce the C-32A's available missions. The C-32A was scheduled for 24 of its own missions, the C-9C was scheduled for 20 missions, the C-37A was scheduled for 17 missions, and the C-20s were scheduled for 30 missions as well as 24 standby missions for the C-32A.

This combination of scheduled missions produced a need for 18 additional missions to be covered. Once again these missions were all in the large aircraft category. Solver choose to purchase one B-757 as the least costly option with the total cost of $1,600,123 per month.

Solver Model, 80% run, no C-9C, no C-20H

The third solver model run uses the same mission requirements as model #3. In this solver model all C-9C's and C-20H's have been removed. As in the first two solver models, the B-767 and B-737 aircraft were added as possible purchase candidates.

Air Force One, the VC-25, received its original 15 missions, the C-137 was scheduled for 9, the C-32A for 20 missions, and the C-37A for 14 missions. As in the first two models, the C-137 missions and the standby missions for the VC-25 were covered by the C-32A. The C-20 was scheduled for 24 missions as well as the 20 standby missions for the C-32A.

Even with the reduction of C-20's, the small aircraft fleet was still able to handle the requirements with room to spare. The large and medium aircraft fleet required the purchase of additional aircraft. The large fleet lacks only one aircraft to cover the short fall of 8 missions. Solver purchased one B-757 for the large aircraft requirement. One B-737 aircraft was also purchased. The 17 missions that were flown on the C-9Cs were directly transferred to the two B-737 aircraft.

When compared to model #3, which did not have the option of purchasing the B-737, it is shown that the least costly alternative is to purchase one B-737 for the C-9C

missions and one B-757 for the C-32A missions instead of purchasing two C-32A aircraft to cover both the large and medium missions. The savings would be $456,022.00. Since at least one aircraft is needed at all times, two B-737 aircraft would actually have to be purchased to account for aircraft in maintenance. In that case purchasing one B-757 and two B-737's would actually be $168,978 more expensive than just purchasing two B-757's.

Solver Model, 100% run, no C-9C, no C-20H

The fourth solver model is like the third but uses the 100% acceptance assumption.

The VC-25 was scheduled for 18 missions, which added the same amount of standby missions to the C-32A. The C-137C was scheduled for 12 missions that were given to the C-32A directly, because of the C-137C's retirement. These scheduled and standby missions gave the C-32A 30 missions before its 24 missions were even scheduled. The C-9C was scheduled for 21 missions and the C-37A aircraft were scheduled for 17 missions with the C-20B scheduled for 30 missions in addition to the 24 standby missions it needed to perform for the C-32A. The 71 small aircraft standby and scheduled missions had no affect on the small aircraft fleet and no additional small aircraft were needed.

Thirty-nine missions required additional support--18 large aircraft missions and 21 medium aircraft missions. Solver purchased one B-757 and two B-737 aircraft at a total cost of $3,444,463 per month. By purchasing one B-757 and two B-737 aircraft, solver saves $786,360 over the purchase of three B-757 aircraft. If three B-737 aircraft

need to be purchased to ensure proper availability, it is still cheaper to purchase three B-737s and one B-757 aircraft than it is to purchase enough B-757 aircraft to cover all of the large and medium missions needed, by $161,360.00.

Solver issues

This particular solver program runs in the nonlinear mode. For this reason, it cannot be guaranteed to give the optimal answer every time. In order to minimize the chance of errors, the user must manually input false numbers in the missions needed boxes. The best results come when the user overestimates the needed missions for the B-737. When all zeros are used in the mission needed boxes, solver will tend to use the B-757 exclusively and will not give the small missions to the B-737. By ensuring that all the missions needed boxes have a number greater than zero, and the B-737 has an overestimated number, solver has worked properly in all test trials.

V. Summary

As stated before, the actual number of validated requests that are turned down for lack of airframes was not available to the author. Because of this, the exact mix of aircraft needed for the Special Airlift Mission fleet cannot be definitively found in this Graduate Research Project. The goal instead was to come up with a working model that could be used by the agencies themselves to determine future requirements.

With the retirement of the last C-137 in 2001, a definite short fall in the large aircraft fleet has been identified. Most recently, with two C-32A aircraft off the line for maintenance instead of the normal one aircraft, additional large aircraft are desperately needed.

The C-9C is also nearing the end of a very long career. Although an older aircraft, it is still physically capable of performing short range missions in the U.S. But because of its age, the technology and equipment it uses is outdated and makes it incompatible for future needs. The new engines and updated electronics needed still do not address the aircraft's lack of range and its inability to fulfill future international needs.

In all instances, the small aircraft purchase was never required. In fact, in only one scenario were small aircraft scheduled missions actually greater than one half of the missions available. In all cases, one C-20B or one C-20H and one C-37A could be removed from the inventory and the remaining fleet could still handle the required missions.

Even though the exact number of aircraft could not be determined by this project, it is easy to see that the current mix of aircraft is lopsided. The previous paragraphs show the over abundance of small aircraft and not enough medium and large aircraft. Thus, more large and medium aircraft should be purchased while removing the two C-20H aircraft. This should bring the fleet towards a more equitable distribution.

To replace the C-9C medium capacity passenger aircraft, a B-737, the C-40B, is a reasonable choice. The C-40B is able to carry approximately the same number of passengers as the C-9C, satisfies engine noise requirements, and has the navigation equipment needed to fly worldwide. Additionally, it has a 5,000+ mile range which allows it to fly to Europe and throughout the Pacific. In fact, the addition of the C-40B may be able to relieve some of the strain on the larger C-32A. Right now, if international travel is required with more than a few people, the C-32A is the only aircraft capable of providing this support. With the addition of the C-40B, if a medium sized group requires international travel, it would cost the government less to fly the C-40B full, instead of the C-32A only partially full.

The addition of another type of large aircraft, such as the B-767, to supplement the current B-757 would, in the author's view, be a poor choice. Keeping the minimum number of aircraft types in the fleet would alleviate many issues. Fewer pilots would be needed with fewer types of aircraft, or at a minimum, and with fewer types of aircraft; pilots would have an easier time keeping current. Maintenance issues would also be simpler with fewer types of aircraft. Even though the Air Force contracts its maintenance out, making the availability of spare parts and the actual work on the aircraft less of a

concern for the Air Force, the price for maintaining multiple types of aircraft would undoubtedly increase the price of the contract.

The author believes that the SAM fleet needs to be transformed back to its 1980s look. It needs more large aircraft and less small aircraft. One more additional C-32A aircraft should be purchased to plus up the large aircraft fleet. A minimum of three C-40B aircraft should be purchased to take the place of the three C-9C aircraft that need to be retired. The small fleet needs no additional aircraft. In fact, reducing the number of small aircraft would benefit the fleet. Losing the two C-20H aircraft would be a logical start and would also help reduce the types of aircraft in the inventory. As the C-20B retires through attrition, it should be replaced with the newer C-37A.

Appendix: Model Runs

Running the Model

The basis for all models is the top half of the excel sheet. The aircraft at Andrews AFB are listed on the upper left portion of the sheet. The user can then fill in each column as aircraft inventories change. The first column is total aircraft in the Andrews AFB inventory. The second column accounts for those aircraft that are in long-term maintenance or depot level maintenance. The column labeled "available" simply subtracts aircraft in maintenance from inventory numbers. The "total missions available" column multiplies the available aircraft times 18, giving us the total missions available per month.

The colored "Scheduled Monthly Missions" column is the primary input for the user. As missions for each type of aircraft are scheduled, the numbers here can be updated. The color code is as follows and continues throughout the program. The red represents Presidential missions. Purple represent large aircraft, orange represents medium sized aircraft, and blue represent small size aircraft. As missions are added to the tally, they are subtracted from the "total missions available" column. The "extra missions needed column will stay at "0" until a deficit appears between the scheduled and available missions. These will then count up as missions are added.

The middle section of the model simply tallies the extra large, medium and small aircraft requirements. Here also are the inputs for missions per month and miles flown per aircraft per day. The user can change these two numbers as updated data becomes available.

The bottom section of the sheet is where excel and the solver determine the number of extra aircraft needed and how much they will cost. "Missions needed" reflect

the middle section of the model and may be distributed between different aircraft depending on the most economical choice. The speed column shows how fast each aircraft can fly and is used in calculating mission duration by dividing the miles flown by speed. The "pax" column simply reminds us of the size of each aircraft. "A/C needed" or aircraft needed is based on the missions needed column. For every portion of 18 missions needed, one aircraft is added to the a/c-needed column.

The flying hour costs for each aircraft can be updated annually or as needed. Missions cost are the mission hours flown (miles/speed) multiplied by the flying hour cost. Acquisition cost can also be updated as costs change from year to year and are then divided into the amount of years it is expected to be used to come up with a monthly cost per aircraft. Missions cost and Monthly acq are then summed and all aircraft are summed to come up with a total monthly cost for all extra missions and aircraft purchased.

To use the model, the user simply needs to update the upper portion of the model with aircraft and mission numbers. When it becomes necessary to determine which aircraft to purchase, a number should be in the missions needed column as discussed in Chapter 5. Then solver should be started with the minimize function selected for the set cell at the lower right of the model. Once solver is initiated, it will determine the least expensive answer.

Excel Model #1

Aircraft	inventory	in mx	available	standby missions	total missions available	**Scheduled Monthly Missions**	extra missions needed	
VC-25	2	1	1		**28**	15	**0**	A # here will decrease C-32A availability by that #
C-137C	0	0	0		**0**	9	**9**	Since C-137 is retired, a # here will reduce C-32A by that #
C-32A	4	2	2	15	**12**	20	**8**	A # here will decrease C-32A & C-20B availability by that #
C-9C	3	1	2		**36**	17	**0**	C-9C Retirement will decrease C-32A by this #
C-37A	3	1	2		**36**	14	**0**	
C-20B/H	7	2	5	20	**70**	24	**0**	

1 plane = 18 missions per month

	Missions needed
L	8
M	0
S	0
Total	8
	constraint

Assume each mission is this many miles: 2000

Daily cost assumes years usability of: 10
and a % of use of: 100

		change	Missions needed	speed	pax	a/c needed	flying hour cost	Missions cost	Acquisition	Monthly acq	Total monthly cost
Boe 757	C-32A		8	530	45	1	$10,062	$ 303,758	$110,000,000	$ 916,667	$ 1,220,425
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	8		AC used	1					$ 1,220,425
		Large	8								
		S/M	0								

Set cell min

* are estimated prices
767 included with tanker lease

Excel Model #2

Aircraft	inventory	in mx	available	standby missions	total missions available	**Scheduled Monthly Missions**	extra missions needed	
VC-25	2	1	1		**28**	18	**0**	A # here will decrease C-32A availability by that #
C-137C	0	0	0		**0**	12	**12**	Since C-137 is retired, a # here will decrease C-32A by that #
C-32A	4	2	2	18	**6**	24	**18**	A # here will decrease C-32A & C-20B availability by that #
C-9C	3	1	2		**36**	21	**0**	C-9C Retirement will decrease C-32A by this #
C-37A	3	1	2		**36**	17	**0**	
C-20B/H	7	2	5	24	**66**	30	**0**	

1 plane = 18 missions per month

	Missions needed
L	18
M	0
S	0
Total	18
	constraint

Assume each mission is this many miles: 2000

Daily cost assumes years usability of: 10
and a % of use of: 100

		change	Missions needed	speed	pax	a/c needed	flying hour cost		Acquisition	Monthly acq	Total monthly cost
Boe 757	C-32A		18	530	45	1	$10,062	$ 683,457	$110,000,000	$ 916,667	$ 1,600,123
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	18		AC used	1					$ 1,600,123
		Large	18								
		S/M	0								

Set cell min

* are estimated prices
767 included with tanker lease

Excel Model #3

Aircraft	inventory	in mx	available	standby missions	total missions available	**Scheduled Monthly Missions**	extra missions needed	
VC-25	2	1	1		**28**	15	**0**	A # here will decrease C-32A availability by that #
C-137C	0	0	0		**0**	9	**9**	Since C-137 is retired, a # here will decrease C-32A by that #
C-32A	4	2	2	15	**12**	20	**8**	A # here will decrease C-32A & C-20B availability by that #
C-9C	0	0	0		**0**	17	**17**	C-9C Retirement will decrease C-32A by this #
C-37A	3	1	2		**36**	14	**0**	
C-20B/H	5	1	4	20	**52**	24	**0**	

1 plane = 18 missions per month

	Missions needed
L	8
M	17
S	0
Total	25
	constraint

Assume each mission is this many miles: 2000

Daily cost assumes years usability of: 10
and a % of use of: 100

		change	Missions needed	speed	pax	a/c needed	flying hour cost		Acquisition	Monthly acq	Total monthly cost
Boe 757	C-32A		25	530	45	2	$10,062	$ 949,245	$110,000,000	$ 1,833,333	$ 2,782,579
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	25		AC used	2					$ 2,782,579
		Large	25								
		S/M	0								

Set cell min

* are estimated prices
767 included with tanker lease

Excel Model #4

Aircraft	inventory	in mx	available	standby missions	total missions available	**Scheduled Monthly Missions**	extra missions needed	
VC-25	2	1	1		**28**	18	**0**	A # here will decrease C-32A availability by that #
C-137C	0	0	0		**0**	12	**12**	Since C-137 is retired, a # here will decrease C-32A by that #
C-32A	4	2	2	18	**6**	24	**18**	A # here will decrease C-32A & C-20B availability by that #
C-9C	0	0	0		**0**	21	**21**	C-9C Retirement will decrease C-32A by this #
C-37A	3	1	2		**36**	17	**0**	
C-20B/H	5	1	4	24	**48**	30	**0**	

1 plane = 18 missions per month

	Missions needed
L	18
M	21
S	0
Total	39
	constraint

Assume each mission is this many miles: 2000

Daily cost assumes years usability of: 10
and a % of use of: 100

		change	Missions needed	speed	pax	a/c needed	flying hour cost		Acquisition	Monthly acq	Total monthly cost
Boe 757	C-32A		39	530	45	3	$10,062	$ 1,480,823	$110,000,000	$ 2,750,000	$ 4,230,823
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	39		AC used	3					$ 4,230,823
		Large	39								
		S/M	0								

Set cell min

* are estimated prices
767 included with tanker lease

Solver Model, 80% run, all aircraft

Aircraft	inventory	in mx	available	standby missions	**total missions available**	Scheduled Monthly Missions	Extra missions needed
VC-25	2	1	1		**28**	**15**	0
C-137C	0	0	0		**0**	**9**	9
C-32A	4	2	2	15	**12**	**20**	8
C-9C	3	1	2		**36**	**17**	0
C-37A	3	1	2		**36**	**14**	0
C-20B/H	7	2	5	20	**70**	**24**	0

This # decreases C-32A availability by that #
Since C-137 is retired, a # here reduces C-32A by that #
A # here reduces C-20B availability by that #

1 plane = 18 missions per month

constraint	Missions needed	a/c needed
L	8	1
M	0	0
S	0	0
Total	8	1

Assume aircraft are flown this many miles/day: 2000

Daily cost assumes
years usability of: 10
and a % of use of: 100

		change	needed	Missions speed	pax	a/c needed			Acquisition	Monthly	
Boe 757	C-32A		8	530	45	1	$10,062	$ 303,758	$ 110,000,000	$ 916,667	$ 1,220,425
Boe 767*	C-XX		0	530	43	0	$13,000	$ -	$ 100,000,000	$ -	$ -
Boe 737*	C-40B		0	530	26	0	$ 7,500	$ -	$ 75,000,000	$ -	$ -
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	8		AC used	1					$ 1,220,425
		Large	8								
		S/M	0								**Set cell min**

* are estimated prices
767 included with tanker lease

Solver Model, 100% run, all aircraft

Aircraft	inventory	in mx	available	standby missions	**total missions available**	Scheduled Monthly Missions	Extra missions needed
VC-25	2	1	1		**28**	**18**	0
C-137C	0	0	0		**0**	**12**	12
C-32A	4	2	2	18	**6**	**24**	18
C-9C	3	1	2		**36**	**21**	0
C-37A	3	1	2		**36**	**17**	0
C-20B/H	7	2	5	24	**66**	**30**	0

This # decreases C-32A availability by that #
Since C-137 is retired, a # here reduces C-32A by that #
A # here reduces C-20B availability by that #

1 plane = 18 missions per month

constraint	Missions needed	a/c needed
L	18	1
M	0	0
S	0	0
Total	18	1

Assume aircraft are flown this many miles/day 2000

Daily cost assumes
years usability of: 10
and a % of use of: 100

		change	needed	Missions speed	pax	a/c needed			Acquisition	Monthly	
Boe 757	C-32A		18	530	45	1	$10,062	$ 683,457	$ 110,000,000	$ 916,667	$ 1,600,123
Boe 767*	C-XX		0	530	43	0	$13,000	$ -	$ 100,000,000	$ -	$ -
Boe 737*	C-40B		0	530	26	0	$ 7,500	$ -	$ 75,000,000	$ -	$ -
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	18		AC used	1					$ 1,600,123
		Large	18								
		S/M	0								**Set cell min**

* are estimated prices
767 included with tanker lease

Solver Model, 80% run, no C-9C or C-20H

Aircraft	inventory	in mx	available	standby missions	**total missions available**	Scheduled Monthly Missions	Extra missions needed
VC-25	2	1	1		**28**	**15**	0
C-137C	0	0	0		**0**	**9**	9
C-32A	4	2	2	15	**12**	**20**	8
C-9C	0	0	0		**0**	**17**	17
C-37A	3	1	2		**36**	**14**	0
C-20B/H	5	1	4	20	**52**	**24**	0

This # decreases C-32A availability by that #
Since C-137 is retired, a # here reduces C-32A by that #
A # here reduces C-20B availability by that #

1 plane = 18 missions per month

constraint	Missions needed	a/c needed
L	8	1
M	17	1
S	0	0
Total	25	2

Assume aircraft are flown this many miles/day 2000

Daily cost assumes
years usability of: 10
and a % of use of: 100

		change	needed	Missions speed	pax	a/c needed			Acquisition	Monthly	
Boe 757	C-32A		8	530	45	1	$10,062	$ 303,758	$ 110,000,000	$ 916,667	$ 1,220,425
Boe 767*	C-XX		0	530	43	0	$13,000	$ -	$ 100,000,000	$ -	$ -
Boe 737*	C-40B		17	530	26	1	$ 7,500	$ 481,132	$ 75,000,000	$ 625,000	$ 1,106,132
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	25		AC used	2					$ 2,326,557
		Large	8								
		S/M	17								**Set cell min**

* are estimated prices
767 included with tanker lease

Solver Model, 100% run, No C-9C or C-20H

Aircraft	inventory	in mx	available	standby missions	**total missions available**	Scheduled Monthly Missions	Extra missions needed
VC-25	2	1	1		**28**	**18**	0
C-137C	0	0	0		**0**	**12**	12
C-32A	4	2	2	18	**6**	**24**	18
C-9C	0	0	0		**0**	**21**	21
C-37A	3	1	2		**36**	**17**	0
C-20B/H	5	1	4	24	**48**	**30**	0

This # decreases C-32A availability by that #
Since C-137 is retired, a # here reduces C-32A by that #
A # here reduces C-20B availability by that #

1 plane = 18 missions per month

constraint	Missions needed	a/c needed
L	18	1
M	21	2
S	0	0
Total	39	3

Assume aircraft are flown this many miles/day 2000

Daily cost assumes
years usability of: 10
and a % of use of: 100

		change	needed	Missions speed	pax	a/c needed			Acquisition	Monthly	
Boe 757	C-32A		18	530	45	1	$10,062	$ 683,457	$ 110,000,000	$ 916,667	$ 1,600,123
Boe 767*	C-XX		0	530	43	0	$13,000	$ -	$ 100,000,000	$ -	$ -
Boe 737*	C-40B		21	530	26	2	$ 7,500	$ 594,340	$ 75,000,000	$ 1,250,000	$ 1,844,340
Gulf 5	C-37A		0	600	12	0	$ 4,396	$ -	$ 39,000,000	$ -	$ -
		Total	39		AC used	3					$ 3,444,463
		Large	18								
		S/M	21								Set cell min

* are estimated prices
767 included with tanker lease

Bibliography

Bautz, C. Presidential Airlift Coordinator, Washington DC. Personal Interview. 12 Oct 2001

Card, A.White House Mission Designation for Travel,Washington DC.March 28, 2001

Early Bird. "*Plan To Lease 4 Jets Added To Defense Bill."* Excerpt from unpublished article. n. pag. http://ebird.dtic.mil/Dec2001/e20011220plan.htm.

Filcek, P. "Analysis of DV Lift Requirements," Systems Requirements Division, 2001.

"*Former Air Force One Retires to Reagan Library."* Excerpt from unpublished article. n. pag. http://www.defenselink.mil/news/Aug2001/b08162001_bt378-01.html. 28 May 2002.

Global Security. "*KC-767 Common Widebody Tanker & Transport."* Excerpt from unpublished article. n. pag. http://www.globalsecurity.org/military/systems/aircraft/kc-767.htm. 28 May 2002.

Holmes, C. W.89OSS/OSOO, Andrews Air Force Base. Personal Interview. December 3,2001

Holmes, C. W. 89OSS/OSOO, Andrews Air Force Base. Personal Communication. April 10, 2002

Irwin, M. T. "Executive Airlift Shortfalls," White House Military Office, Washington DC, Information Paper, 2001.

Miner, J. E. *Special Air Missions: A Path to the 21st Century*. Research Department, Air Command and Staff College, Maxwell AFB, 1997, March.

Mischo, M. S. Special Air Missions Pilot, Fort Dix, NJ. Personal Interview.April 17, 2002

Office of Public Affairs Air Mobility Command. "*USAF Fact Sheet."* Excerpt from unpublished article. n. pag. http://www.af.mil/news/factsheets. Oct 19, 2001.

Perry, D. A. Fort Dix, NJ. Personal Interview.7 Feb 02

Pike, J. "*Special Air Mission."* Excerpt from unpublished article. n. pag. http://www.fas.org/man/dod-101/sys/ac/sam.htm. Oct 12 2001.

White House Military Office. "FY01 Flying Hour Cost," Washington DC, 2001.

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Van Noord, Jonathan R., Major, USAF

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14. ABSTRACT

The VIP/SAM fleet at Andrews AFB supports the air transportation of the President and other Washington D.C. dignitaries. Over the last 20 years, the fleet of aircraft have changed in type and numbers. Currently, the fleet cannot support all the requests for airlift it receives. This GRP looks at the aircraft currently assigned to the VIP/SAM fleet and the historical data of missions they fly. With this information and future aircraft possibilities, a model was constructed for the White House Military Office to use to determine the appropriate types and numbers of aircraft given the number of missions scheduled

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a. REPORT	b. ABSTRACT	c. THIS PAGE			Dr. James T. Moore, ENS
U	U	U	UU	44	19b. TELEPHONE NUMBER *(include area code)* (937)255-6565,ext 4337